Illinois Department of Transportation

Memorandum

To:	ALL BRIDGE DESIGNERS	01.1
From:	Ralph E. Anderson	Ralph E. Anderson
Subject:	Three-Sided Precast Concrete Structures	
Date:	February 5, 2001	

This bridge memorandum supersedes the previously issued Bridge Memorandum 00.4.

Three-sided, precast concrete structures offer a cost-effective, convenient solution for a variety of bridge needs. The ease and short duration of construction for these bridges make them an attractive alternative which may be considered on certain projects. Three-sided precast concrete structures shall be planned and designed according to the following guidelines.

Design Limitations:

1. 45° maximum skew.

2. 12.8 m (42 ft.) maximum design span measured from inside face of sidewalls along the longitudinal axis of unit.

3. 4 m (13 ft.) maximum rise measured from top of footing/pedestal wall to bottom of top slab.

4. 150 mm (6 in.) minimum cover measured from pavement surface at roadway edge.

5. 1.2 m (4 ft.) minimum embedment measured from bottom of footing to streambed elevation.

Planner/Designer Responsibilities:

1. For each project, the above limitations and combinations thereof shall be verified through the approved manufacturers that are listed in the special provisions. In addition, the cost of any temporary soil retention system shall be included in the economic evaluation. Complex soil retention systems due to stage construction may negate the cost-effectiveness of staging a Three-Sided Precast Concrete Structure.

2. Hydraulic and waterway opening requirements shall be handled similarly to any other bridge project; a scour analysis shall be performed.

3. Foundation borings are required for all such projects. The soil and foundation design (i.e. slope stability, settlement, spread footings, piling, etc.) must be performed and sealed by an Illinois Licensed Structural Engineer. Suppliers of three-sided, precast concrete structures shall be contacted for loads, reactions, etc. to be utilized in the foundation design. Footings supported by rock or piles shall be analyzed as unyielding foundations according to Article 6.2.2 of AASHTO.

4. All joints between segments shall be sealed according to Article 540.06. When the minimum fill over the structure, between the edges of the shoulders, is less than or equal to 1 m (3 feet), a grouted keyway at the top joint or other approved mechanical connection shall be used to connect a minimum length of 3.65 m (12 ft.) of exterior segments at each end of the structure.

5. The actual design of the three-sided precast concrete structure is the responsibility of the supplier. Shop drawings for the three-sided structure sections and all other precast elements along with formal structural calculations, must be submitted to the Bureau of Bridges and Structures for approval. Shop drawings shall be certified by the supplier as being designed in accordance with AASHTO. The supplier shall also indicate any additional backfilling requirements that must be met beyond those found in the Standard Specifications and shall show the limits of those backfilling requirements.

Site Limitations:

Three-sided, precast concrete structures may be impacted by the following conditions:

1. Flowline is underlain by scour-susceptible sandy soils. A scour evaluation is required and protective measures, if necessary and appropriate, shall be provided.

2. High Seismic areas (Category C), unless special foundation treatments and/or anchoring devices can be provided effectively and economically.

3. Weak soil conditions which would require piling foundations.

When above conditions would impose relatively high additional costs, a cost comparison is required to justify a three-sided, precast concrete structure compared to other bridge/culvert alternatives.

Plan Processing Procedures:

1. TSL plans will be required for all projects utilizing a three-sided, precast concrete structure.

2. TSL and final plans for three-sided, precast concrete structures shall identify the size (span x rise), length, and skew angle (in 1° increments) of the bridge.

3. A detailed design of the three-sided precast concrete structure with precast headwalls and precast wingwalls are not required on the final plans. However, final plans shall include all geometric dimensions and a detailed design for all cast-in-place foundation units and cast-in-place headwalls and wingwalls. In addition, the following general note shall be shown in the final plans:

   "The footing design is based on the following maximum reactions applied at the top of the footing/pedestal wall:

   Exterior footings: xx (vertical), xx (horizontal).
   Interior footings: xx (vertical).

   The Contractor shall verify that the selected structure meets these design parameters. If the design parameters are exceeded, a complete footing design with calculations, details and the required seals shall be submitted for review and approval."

4. Final plans shall include the pay item Three-Sided, Precast Concrete Structures, *Span* x *Rise* and applicable pay items for the remainder of the substructure elements.

5. Final plans shall be submitted along with all pertinent special provisions to the Bureau of Bridges and Structures for review and approval.

6. Shop drawings of all precast elements including the detailed design of the three-sided, precast concrete structure shall be prepared and submitted by the Supplier for review and approval. The shop drawings will be incorporated as part of the as-built plans.

To facilitate the initiation of this type of project, the Bureau of Bridges and Structures will be available to assist the Districts/Consultants in working out problems which may arise during plan development.

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